Listing of the Claims

This listing of claims will replace all prior versions, and listings, of claims in this Application:

1. (Currently amended) A method of improving surface properties of cast aluminum alloys comprising: providing a molten aluminum alloy; humidifying a gas to a predetermined moisture content to form a humidified atmosphere; introducing the humidified atmosphere near contacting a surface of the molten aluminum alloy ~~with a humidified atmosphere having a higher moisture content than a surrounding ambient atmosphere~~; and substantially maintaining the predetermined moisture content of the humidified atmosphere near the surface during solidifying solidification phase of the molten aluminum alloy.

2. (Cancelled)

3. (Previously presented) The method of claim 1 wherein the surface of the molten aluminum alloy is subjected to the humidified atmosphere by forcing a humidified gas over the surface of the molten aluminum alloy.

4. (Original) The method of claim 3 wherein the humidified gas comprises at least one of: air, helium, argon, nitrogen, carbon dioxide, carbon monoxide, products of combustion of natural gas or fuel oil, methane, ethane, propane, natural gas, organic fluorine compounds, organic chlorine compounds and organic fluoro-chloro compounds.

5. (Original) The method of claim 1 wherein the molten aluminum alloy is solidified by a casting method.

6. (Original) The method of claim 5 wherein the casting method comprises direct chill casting, electromagnetic casting, horizontal direct chill casting, hot top casting, continuous casting, semi-continuous casting, belt casting, die casting, roll casting, slab casting, sand casting, centrifugal casting, lost foam casting, permanent mold casting, plaster casting, pressure die casting and/or vacuum casting.

7. (Original) The method of claim 6 wherein the casting method is employed at a temperature of between about the solidus temperature of the alloy and about 300° F (149° C) above the liquidus temperature of the alloy.

8. (Original) The method of claim 6 wherein the casting method is employed at a temperature of between about 50° F (10° C) above the liquidus temperature of the alloy and about 200° F (93° C) above the liquidus temperature of the alloy.

9. (Original) The method of claim 1 wherein the aluminum alloy comprises at least about 0.1 wt. % magnesium.

10. (Original) The method of claim 1 wherein the aluminum alloy comprises at least about 0.2 wt. % magnesium.

11. (Original) The method of claim 1 wherein the aluminum alloy comprises at least about 0.3 wt. % magnesium.

12. (Original) The method of claim 1 wherein the aluminum alloy is a 1XXX, 2XXX, 3XXX, 4XXX, 5XXX, 6XXX, 7XXX or 8XXX series wrought alloy.

13. (Original) The method of claim 12 wherein the aluminum alloy is selected from the group of 7050, 7055, 7085, 7150 and 7075.

14. (Original) The method of claim 12 wherein the aluminum alloy is a 5182, 5086, 5454, 5052 and 5083.

15. (Original) The method of claim 1 wherein the aluminum alloy is a 100, 200, 300, 400, 500, 600, 700 or 800 series cast alloy.

16. (Original) The method of claim 1 wherein the aluminum alloy comprises up to about 50 wt. % Mg.

17. (Presently Amended) The method of claim 1 wherein the ~~humidified atmosphere has a~~ predetermined moisture content [[of]] ranges from about 0.009 kg/m^3 to about 0.2 kg/m^3.

18. (Original) The method of claim 1 wherein the ~~humidified atmosphere has a~~ predetermined moisture content [[of]] ranges from about 0.01 kg/m^3 to about 0.07 kg/m^3.

19. (Original) The method of claim 1 wherein the solidified molten aluminum alloy is provided in the form of an ingot.

20. (Original) The method of claim 19 further comprising working the ingot.

21. (Original) The method of claim 19 wherein working the ingot comprises at least one of: hot rolling, cold rolling, extruding, forging, drawing, ironing, aging, forming and stretching.

22. (Original) A method for limiting the growth of surface oxide on aluminum-magnesium alloys comprising: providing a molten aluminum alloy having at least 0.1 wt. % magnesium; contacting a surface of the molten aluminum with a humidified atmosphere having a moisture content above about 0.005 kg/m^3; and solidifying the molten aluminum alloy.

23. (Original) The method of claim 22 wherein the humid atmosphere has a moisture content of from about 0.009 kg/m^3 to about 0.2 kg/m^3.

24. (Original) The method of claim 22 wherein the humid atmosphere has a moisture content of from about 0.01 kg/m^3 to about 0.07 kg/m^3.

25. (Withdrawn) A cast aluminum-magnesium alloy product comprising at least about 0.1 wt. % Mg, and up to about 50 wt. % Mg, wherein the cast product has a surface oxide layer comprising magnesium oxide, magnesium hydroxide, magnesium oxy/hydroxide, aluminum oxide and/or spinel forms of oxides.

26. (Withdrawn) The alloy of claim 25 wherein the surface oxide layer has a thickness of less than about 8,000 angstroms.

27. (Withdrawn) The alloy of claim 25 wherein the surface oxide layer has a thickness of less than about 5,000 angstroms.

28. (Withdrawn) An apparatus for casting an aluminum alloy comprising: a molten aluminum containment vessel; and a humidified gas injector in flow communication with the containment vessel.

29. (Currently amended) A method of improving surface properties of cast aluminum alloys comprising: providing a molten aluminum alloy; humidifying a gas to a predetermined moisture content to form a humidified atmosphere; introducing the humidified atmosphere near ~~contacting~~ a surface of the molten aluminum alloy ~~with a humidified atmosphere having a higher moisture content than a~~ surrounding ~~ambient atm~~osphere; and substantially maintaining the predetermined moisture content of the humidified atmosphere near the surface during ~~solidifying~~ solidification phase of the molten aluminum alloy, wherein the humidified atmosphere contacts the surface of the molten aluminum alloy from at least a time the molten aluminum alloy is introduced to a casting apparatus to at least a time when the molten aluminum alloy forms a surface oxide layer having a thickness sufficient to prevent breakthrough egress of the molten aluminum alloy.